Wind Diesel Hybrid Design Experience

6 Years of Ascension Island Wind Farm Operations

Shawn West/Gary Seifert

INEEL

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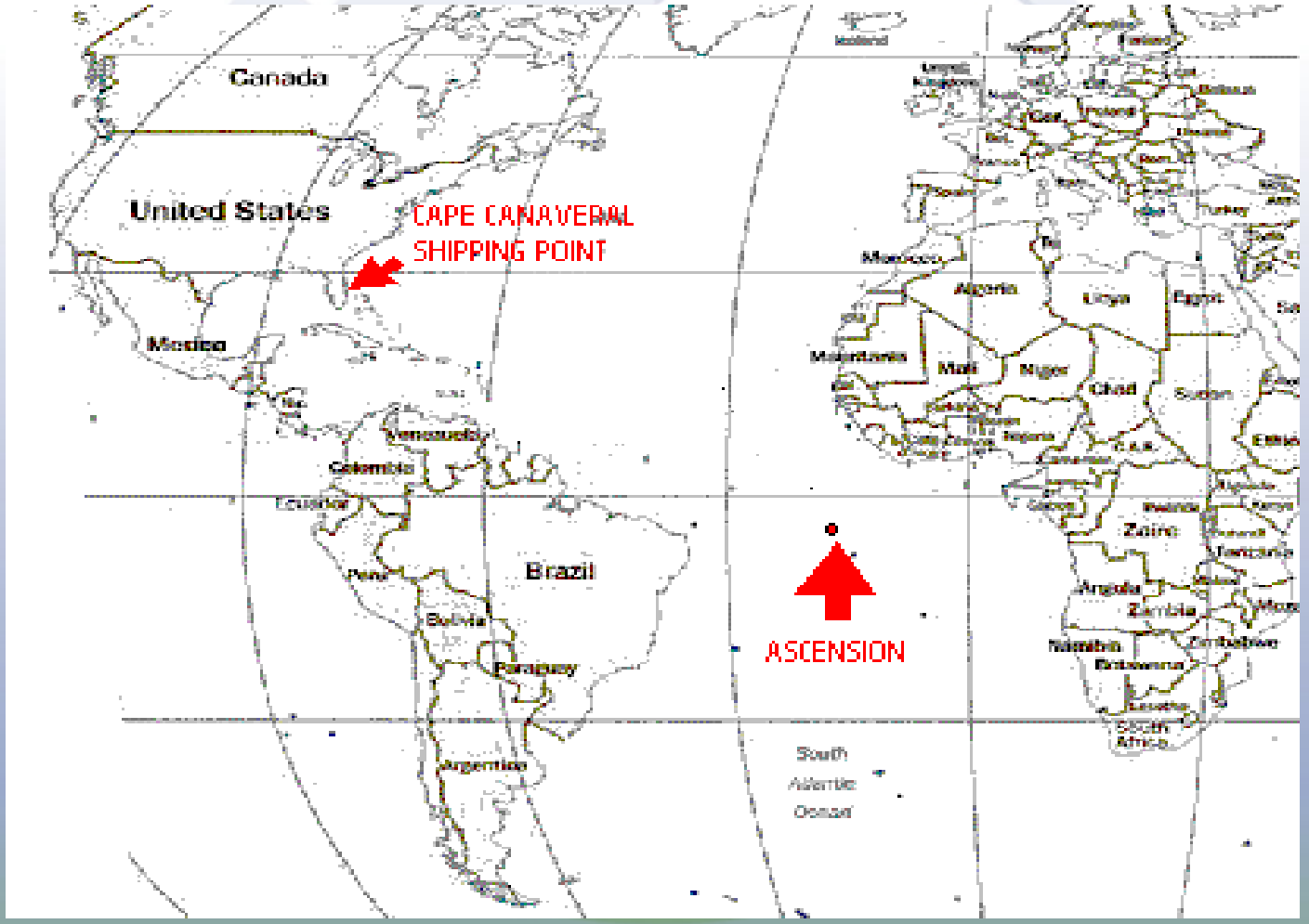
Background information



Background information

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- ***Air Force power generated by a prime power diesel-electric plant***
- ***Air Force load averages 2.2 to 2.4 MW***
- ***Two 1900 kW diesel generators operate in parallel with the wind farm***
- ***Waste engine heat powers the desalination system***


CAUTION
HAZARDOUS
WASTE AREA
LABELED
DRUMS ONLY
12/3/1998


STEAM
CONDENSATE RETURN
12/3/1998


TOYOTA
12/3/1998

Construction

- *Project funded through AF Energy Conservation Investment Program (ECIP)*
- *Designed by DOE's Idaho National Engineering and Environmental Laboratory*
- *Prime contractor was joint venture between Pacific Industrial Electric and Difko Administration (US) Inc.*
- *Concept to construction complete - in 45 months*
- *Awarded Sept 95 with a 540 day performance period*
- *Project completed Sept 96 - 6 months ahead of schedule*

Long History of Wind On Ascension

The Wind farm at Ascension

CHALLENGES

- *Remote shipping - 5000 miles from Port Canaveral*
- *Restricted shipping schedules*
- *Pier restrictions*
- *Limited crane reach*
- *Limited island access*

Other Possibilities

Just remember anything that could go wrong probably will

Planning is Key!

The Team

Background Information

- *Four three-bladed 225 kW MICON wind turbines for a total of 900 kW*
- *Average Ascension wind speed: 7.8 m/s (17.5 mph)*
- *4 Up-wind Micon Turbines (40/225kW EA.)*
- *30m Tower Height (Hub)*
- *Fixed Pitch Stall Regulated*
- *29.8 m Rotor Diameter*

Background Information

- *The wind farm supplements the diesel power plant*
- *4 year simple payback*
- *Average wind power output is 342 kW*
  - *38% capacity factor*
- *To meet base electrical load the power plant operates two 1900 kW generators creating a low load factor on the generators*
- *One generator operation less stable*

PERFORMANCE

- *19,200,000 kWhrs Between Oct 96 And Sept 02*
- *Downtime between 89 hours 489 hours per year*
- *>97% Availability*
- *Replaced one gear box, transformer, varistor, breaker, and many mounting plates*
- *Corrosion control a challenge*
- *Saved 1,440,000 gallons of fuel to date*
- *Significant Nox and CO reduction*

Corrosion Control is a Challenge

Site Approval & Environmental

- Site approval
  - Location required negotiating a lease
    - Involving island administrator early on was important
- Environmental
  - Two main issues
    - Bird strikes
    - Electro-magnetic interference
  - Land animals were not an issue

LESSONS LEARNED

- *Perform resource assessments*
- *Mandatory job walk essential*
- *Partner with the teams at the beginning*
- *Performance based specifications*
- *Conquer corrosion control*
- *Work the load management into the control systems for stability*
- *Establish maintenance contract*
- *Plan and model loads up front*
- *Wind/Diesel systems are very compatible*

Follow-on Project

- Description
  - 1800 kW (2 Micon 900 turbines)
  - Electric boiler for grid stability and fresh water production
- Schedule
  - Design and Bidding complete
  - 400-700 day construction period
  - Contract award Sept 02
  - Swanson (from Anchorage) is the Prime

After

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